Chi-Square Test Correlation of Physical Activity of Obese Children of Three Libyan Cities

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Abstract

Background: *The highest prevalence of childhood obesity has been observed in developed countries. However, its prevalence is increasing in developing countries as well.*

Objectives: *To evaluate demographic variation in the prevalence of obesity among 1361 children and adolescents of three Libyan cities Tripoli, Zawia, and Geryan (**Tripoli** – girls; n = 369, boys; n = 290, **Zawia** – girls; n = 250, boys; n = 89, and **Geryan** – girls; n = 230, boys; n = 133) aged 3–19 years.*

Methods: *The study was carried out at Central Tripoli Pediatric Hospital during a year 2016/17.*

The researcher took the anthropometric measurements into the nurse's room of the out-patient department (OPD) and gave a questionnaire to children to be answered by one of the child's parents. The questionnaire included questions related to the socioeconomic status, lifestyle (physical activity and eating habits) and family history of overweight and obesity.

In this paper, a Chi-square test of independence is used to measures whether there is a relationship between gender and physical activity.

The **results** *show that there is a significant relationship between the physical activity and the gender for all three cities.*

Keywords: *obesity, three Libyan cities, children, chi-square test.*

INTRODUCTION

Childhood obesity is an epidemic of global proportions, accompanied by an alarming increase in various metabolic disorders.

The etiology of obesity seems to be associated with several factors, such as genetic polymorphisms (Lai et al., 2013; Boström et al., 2012), dysfunction of the hypothalamic hormone signaling related to satiety, appetite and hunger (Arruda et al., 2011; Thaler et al., 2010), increased release of proinflammatory adipokines by white adipose tissue, and positive energy balance, in which the high total calorie intake, mainly high intake of energy-dense foods rich in saturated fats (Borg et al., 2012), sugar and salt exceeds daily calorie requirement (Drewnowski et al., 2012).

The majority of cardiovascular disease is caused by risk factors that can be controlled, treated or modified such as high blood pressure, cholesterol, overweight/obesity, tobacco use, lack of physical activity, and diabetes [7].

Obesity is associated with a high rate of morbidity and early mortality if untreated (Lew, 1985; Hubert et al., 1983)and its prevalence among children and adolescents has increased significantly in the developed countries during the past two decades (Chinn et Rona, 2001; Baur, 2002) and the similar trends are being observed even in the developing world [12].

In 2007, Forbes ranked Libya as 78th out of 194 countries in the list of world's fattest countries, with 53.2% of adults aged 15 or older being overweight or obese (Streib, 2007).

Obesity is rampant in Libya as 30.5% of Libyan adults (Ministry of Health Libya, 2009), 16.9% of children aged 5 or younger (Ministry of Health Libya, 2008) and 6.1% of children aged between 10 and 18 are obese (WHO, 2007). There is no available study of children aged between 5 to 10 years.

Regular physical activity (PA) has been associated with various positive health aspects such as a decreased risk of chronic or generic illnesses: coronary heart disease, obesity, cancer, type 2 diabetes, sexual dysfunction and cognitive impairment (Haskell et al., 2007; Penedo et Dahn, 2005).

There has been evidence that the inclusion of regular PA as part of a healthy lifestyle is related in a positive way to other health indicators such as perceived health status (Aarnio et al., 2002; Strong et al, 2005) self-image (Strong et al., 2005; Biddle et Mutrie, 2001; Faulkner et al., 2007; Nelson et Gordon-Larsen, 2006; Iannotti et al., 2009) quality of life (Boyle et al., 2010) and quality of peer relationships (Vilhjalmsson et Thorlindsson, 1998; Spriggs et al, 2007). However, the extent of influence of the family on PA (Frenn et al., 2005; Iannotti et al., 2005) and the potential relationship of adolescent PA to the quality of family relations have not been investigated.

The aim and the objectives of this study were to assess the magnitude of obesity among male and females Libyan children (3–19 yrs.), and to find the possible association between obesity and physical activity among them.

The study concludes that there is a high prevalence of obesity among children in those three cities in Libya.

The findings of the current study have been demonstrated with children in Tripoli city. It is the capital and the largest city of Libya at the seaside with a population of about 1,1 million peoples with a density of about 4500/km^2 (12000/sq mi), with a total area of about 400km^2 (200 sq mi). Children living here are significantly less active and have a higher percentage of obesity and sedentary time than those living in Zawia and Geryan cities.

This could be due to rapid nutrition transition which starter earlier in Tripoli than other cities.

In addition, Tripoli has the highest socioeconomic status among these cities, which may be a contributor to increasing in the prevalence of obesity.

Also, it might be due to ethnicity, the timing of puberty, and genetic admixtures.

Also lack of availability of sports grounds, parks, and facilities that are suitable to engage in physical activities or sport, and increased humidity especially in the summertime.

The environment in Zawia city which accounts approximately 200,000 population in an area of 2890 km^2 (1116 sq mi) and density of 101/km^2 (262/sq mi), has poor street connectivity, less green spaces, lower residential density than Tripoli and low socioeconomic status, these factors have been widely reported to influence walkability Inbuilt environments and resulting in a ceiling effect for walking.

In Geryan city which accounts approximately 161,408 population in an area of 4660 km^2 also has poor street connectivity, less green spaces and moreover, the desert climate of Geryan city is ordinarily hot conducive to engagement in physical activity for substantial part of the year.

The low levels of physical activity and a high percentage of obesity amongst male and females from three cities might be related to certain aspects of their lifestyle, dietary habits, and environmental factors.

Generally, engagement in physical activity by young children in Libya is not regarded as a desired pursuit (leisure time activity) due to cultural attitudes and beliefs.

It is commonly perceived that the pursuit of academic excellence has higher status than physical activity.

Usually, parents encourage their children to engage in educational and spiritual activities rather than leisure time activities.

METHODS

Data were collected from the pediatric nutrition clinic (PNC) of the outpatient department (OPD), at Tripoli pediatric central Hospital, these children were referred to the nutrition clinic by the pediatricians for nutritional assessment and to be follow-up by dieticians for further nutritional treatment. There were a total of 1361 child recruited as the subjects in this study, 849 female, and 512 male age 3–19 years old attending different clinics (for different reasons such as obesity, underweight, diabetes mellitus and anemia, etc.), Exclusion criteria include subjects with any congenital abnormalities or cancer diseases. The data were collected in a period of about a year 2016/17.

All children selected for this study had Libyan nationality. The questionnaire was a face-to-face interview to assess the children's lifestyle and health status. Questions included the duration of physical activity done by minutes per week, intensity of physical activity was also included and answered as vigorous, moderate, light, and none.

Researchers took anthropometric measurements, such as weight in kilograms (kg) and height in centimeters (cm), weight and height were taken using the standard procedure. All measurements were performed by trained nutritionists or physical education teachers.

The anthropometric measurements were conducted according to the Anthropometry Procedures Manual (2000) proposed by the National Health and Nutrition Examination Survey.

For measuring weight, each examiner was supplied with weighing scale with height bars attached to it on which weight was measured in kilograms using a standardized procedure (lightly dressed, without shoes). Subjects stood in the center of the scale platform facing the recorder, hands at side, looking straight ahead. The recorder took the measurements to the nearest 0.1 kilograms. Height was measured by stadiometer in centimeters with subjects asked to stand up straight without shoes and with the head pointing straight forward. Subjects were asked to remove any accessories such as jewelry and hijab (covering) from the top of the head, in order to properly measure stature. Subjects were asked to stand on the floor with the heels of both feet together, and the toes pointed slightly outward at approximately a 60^{o}angle. After making sure that the body weight was evenly distributed with both feet flat on the floor, proper heel position, and the buttocks, shoulder blades, and back of the head in contact with the vertical backboard, the recorder, at eye level of the headboard, took the height to the nearest 0.1 centimeter and this value was converted to meters.

Body Mass Index (BMI) variable was calculated using the following formula: BMI = Weight (kg)/ Height-square (m^2), The BMI values were calculated for each gender and age. Data was computerized and analyzed using the spreadsheet Excel and SPSS statistical package.

In this paper we examine whether there is a relationship between gender (male, female) and the physical activity of the obese children in three Libyan cities, Chi-square test is employed to determine this statistical relationship. Chi-square test of independence measures whether there is a relationship between two categorical variables.

Chi-square test used when the variables are nominal or categorical. In this study, we assumed that the physical activity was splitting up into; the intensity of physical activity (none, light, moderate, and vigorous), and duration of physical activity (none per week, 60 minutes per week, 90 minutes per week, and 120 minutes per week). The analysis was performed for each city separately.

Summary of children's BMI for age and the prevalence of overweight and obesity among children in three Libyan cities using the CDC standard according to gender were demonstrated in tables 1–3. Since this study focused on the obese cases only, for that reason elimination of other cases has been done for the sample selected. The goal of this analysis is to figure out the reacts or responds of obese children with physical activity. The other categories such as normal and

overweight children certainly have a different approach of reaction to physical activity and could be proposed for future work.

Table 1: Summary of children's BMI for age in Tripoli

Summary of Children's BMI-for-Age			
	Boys	Girls	Total
Number of children assessed:	290	369	**659**
Underweight (< 5th %ile)	0%	0%	**0%**
Normal BMI (5th - 85th %ile)	0%	0%	**0%**
Overweight or obese (≥ 85th %ile)*	100%	100%	**100%**
Obese (≥ 95th %ile)	*100%*	*100%*	***100%***
*Terminology based on: Barlow SE and the Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. Pediatrics. 2007;120 (suppl 4):s164-92.			

Source: a study of the authors

Table 2: Summary of children's BMI for age in Zawia

Summary of Children's BMI-for-Age			
	Boys	Girls	Total
Number of children assessed:	89	250	**339**
Underweight (< 5th %ile)	0%	0%	**0%**
Normal BMI (5th - 85th %ile)	0%	0%	**0%**
Overweight or obese (≥ 85th %ile)*	100%	100%	**100%**
Obese (≥ 95th %ile)	*100%*	*100%*	***100%***
*Terminology based on: Barlow SE and the Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. Pediatrics. 2007;120 (suppl 4):s164-92.			

Source: a study of the authors

Table 3: Summary of children's BMI for age in Geryan

Summary of Children's BMI-for-Age			
	Boys	Girls	Total
Number of children assessed:	133	230	**363**
Underweight (< 5th %ile)	0%	0%	**0%**
Normal BMI (5th - 85th %ile)	0%	0%	**0%**
Overweight or obese (≥ 85th %ile)*	100%	100%	**100%**
Obese (≥ 95th %ile)	*100%*	*100%*	***100%***
*Terminology based on: Barlow SE and the Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. Pediatrics. 2007;120 (suppl 4):s164-92.			

Source: a study of the authors

RESULTS AND DISCUSSION

Table 4: Gender vs. Intensity of Physical Activity Cross tabulation / Tripoli

			Intensity of Physical Activity				Total
			None	Light	Moderate	Vigorous	
Gender	Female	Count	74	109	160	26	369
		Expected Count	81.2	112.5	143.3	31.9	369.0
	Male	Count	71	92	96	31	290
		Expected Count	63.8	88.5	112.7	25.1	290.0
Total		Count	145	201	256	57	659

Source: a study of the authors

Table 5: Chi-Square Tests of Intensity of Physical Activity / Tripoli

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.592[a]	3	.035
Likelihood Ratio	8.619	3	.035
Linear-by-Linear Association	1.059	1	.303
N of Valid Cases	659		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 25.08.

Source: a study of the authors

Table 6: Gender vs. Duration of Physical Activity Cross tabulation / Tripoli

			Duration of Physical Activity				Total
			None	60 minutes / Week	90 minutes / Week	120 minutes / Week	
Gender	Female	Count	100	136	103	30	369
		Expected Count	99.7	116.5	109.7	43.1	369.0
	Male	Count	78	72	93	47	290
		Expected Count	78.3	91.5	86.3	33.9	290.0
Total		Count	178	208	196	77	659

Source: a study of the authors

Table 7: Chi-Square Tests of Duration of Physical Activity / Tripoli

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.455[a]	3	.001
Likelihood Ratio	17.543	3	.001
Linear-by-Linear Association	7.057	1	.008
N of Valid Cases	659		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 33.88

Source: a study of the authors

Table 8: Gender vs. Intensity of Physical Activity Cross tabulation / Zawia

			Intensity of Physical Activity				Total
			None	Light	Moderate	Vigorous	
Gender	Female	Count	90	72	73	15	250
		Expected Count	98.1	59.0	76.0	17.0	250.0
	Male	Count	43	8	30	8	89
		Expected Count	34.9	21.0	27.0	6.0	89.0
Total		Count	133	80	103	23	339
		Expected Count	133.0	80.0	103.0	23.0	339.0

Source: a study of the authors

Table 9: Chi-Square Tests of Intensity of Physical Activity / Zawia

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.756[a]	3	.002
Likelihood Ratio	16.908	3	.001
Linear-by-Linear Association	0.023	1	.880
N of Valid Cases	339		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.04.

Source: a study of the authors

Table 10: Gender vs. Duration of Physical Activity Cross tabulation / Zawia

			Duration of Physical Activity				Total
			None	60 minutes / Week	90 minutes / Week	120 minutes / Week	
Gender	Female	Count	34	73	113	30	250
		Expected Count	42.8	63.4	104.7	39.1	250.0
	Male	Count	24	13	29	23	89
		Expected Count	15.2	22.6	37.3	13.9	89.0
Total		Count	58	86	142	53	339

Source: a study of the authors

Table 11: Chi-Square Tests of Duration of Physical Activity / Zawia

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22.902[a]	3	.000
Likelihood Ratio	22.288	3	.000
Linear-by-Linear Association	0.021	1	.885
N of Valid Cases	339		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 13.91.

Source: a study of the authors

Table 12: Gender vs. Intensity of Physical Activity Cross tabulation / Geryan

			Intensity of Physical Activity				Total
			None	Light	Moderate	Vigorous	
Gender	Female	Count	53	149	23	5	230
		Expected Count	52.6	135.0	34.8	7.6	230.0
	Male	Count	30	64	32	7	133
		Expected Count	30.4	78.0	20.2	4.4	133.0
Total		Count	83	213	55	12	363

Source: a study of the authors

Table 13: Chi-Square Tests of Intensity of Physical Activity / Geryan

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.424[a]	3	.001
Likelihood Ratio	16.917	3	.001
Linear-by-Linear Association	7.047	1	.008
N of Valid Cases	363		

a. 1 cells (12.5%) have expected count less than 5. The minimum expected count is 4.40.

Source: a study of the authors

Table 14: Gender vs. Duration of Physical Activity Cross tabulation / Geryan

			Duration of Physical Activity				Total
			None	60 minutes / Week	90 minutes / Week	120 minutes / Week	
Gender	Female	Count	50	133	44	3	230
		Expected Count	48.8	124.2	51.3	5.7	230.0
	Male	Count	27	63	37	6	133
		Expected Count	28.2	71.8	29.7	3.3	133.0
Total		Count	77	196	81	9	363

Source: a study of the authors

Table 15: Chi-Square Tests of Duration of Physical Activity / Geryan

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.136[a]	3	.043
Likelihood Ratio	7.924	3	.048
Linear-by-Linear Association	4.332	1	.037
N of Valid Cases	363		

a. 1 cells (12.5%) have expected count less than 5. The minimum expected count is 3.30.

Source: a study of the authors

Table 4 demonstrated the cross-tabulation of the intensity of physical activity with gender for Tripoli sample, where the real and expected counts are shown.

The Pearson Chi-square value in table 5 determines whether if there is a statistical significance in the relationship between the gender and physical activity. The value of Pearson Chi-square is

8.592 associated with P value (0.035) which is less than 0.05. This means that one can reject the null hypothesis and consider that there is a significance relationship between gender and physical activity of Tripoli sample.

The rest of results were illustrated in tables 6–15 are summarized in the following table.

Table 16: Summarized results

	Chi square test value	Associated P value
Gender vs. Duration of physical activity/Tripoli	17.455	0.001
Gender vs. Intensity of physical activity/Zawia	14.756	0.002
Gender vs. Duration of physical activity/Zawia	22.902	0.000
Gender vs. Intensity of physical activity/Geryan	17.424	0.001
Gender vs. Duration of physical activity/Geryan	8.136	0.043

Source: a study of the authors

We can conclude that there is a statistical significant relationship between the gender and intensity of physical activity as well there is a statistical significant relationship between the gender and duration of physical activity.

CONCLUSION AND RECOMMENDATION

There is a general lack of availability of parks, sports grounds, and facilities that are suitable for youth to engage in physical activities or sports.

Furthermore, the climate is not conducive to engagement in physical activity in outdoors for a substantial part of the year, a problem further compounded by the harsh desert environment and the absence of walkability and appropriate indoor facilities for exercise.

This might be part of the reason why children in three Libyan cities are less active. Moreover, attitudes, societal norms, and expectations of communities in Libya are generally less amenable towards engagement in sporting activities that require adherence to particular forms of dress than other communities.

The finding of this study could inform Libyan health policies about interventions in the obesogenic environments that might slow the obesity epidemic and contain the public health crisis.

This study suggests that further research is needed to understand the effect of different modes, intensities, duration, and frequencies of physical activity on weight gain, weight loss, weight stability.

The study recommends to overcome barriers to physical activity by;

1. Recognize the problem: measure height and weight, and plot body mass index on growth charts at each visit.
2. Acknowledge children and their families about physical activity patterns.
3. Encourage the whole family to become involved in the daily activity.
4. Support progressive and well-defined steps.
5. Limit sedentary behavior.
6. Encourage adherence to daily physical activity programs in schools.
7. Support local community initiatives aimed at increasing activity.
8. Advocate for safer and more accessible communities that are more conducive to increased activity.

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